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ABSTRACT

To determine whether the impressive rates for speed reading (e.g., 500 words per minute) can be approximated in speed listening, two experiments compared the comprehension level of material heard at a normal speaking rate with that heard at accelerated rates. In the first experiment, the major demonstration experiment, three groups of college students--a control group, a group given three hours of training in listening at normal speed, and a group given an equal amount of training in speed listening--were given comprehension tests of (1) material presented at a normal speaking rate, approximately 180 words per minute; (2) "skimmed" material, having unnecessary words deleted so as to produce a presentation rate of 230 words per minute (rate was determined by dividing the number of words in the original passage by the number of minutes it took to play back the skimmed version); (3) original material speeded up, with pitch correction, to 400 words per minute; (4) material skimmed and accelerated to 500 words per minute; and (5) new material (no presentation). While comprehension following speed listening was below that following a normal presentation, the amount of information acquired per unit of listening time was greater under speed listening conditions. Surprisingly, practice in speed reading had little effect on comprehension, both in this and in the second experiment, which increased practice listening experience time to about 16 hours. The document notes that, beyond its theoretical interest, research in speed listening can be applied to programs for the reading disadvantaged and for situations where communication must be restricted to auditory channels. (MM)

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SPEED LISTENING:

Exploring an Analogue of Speed Reading

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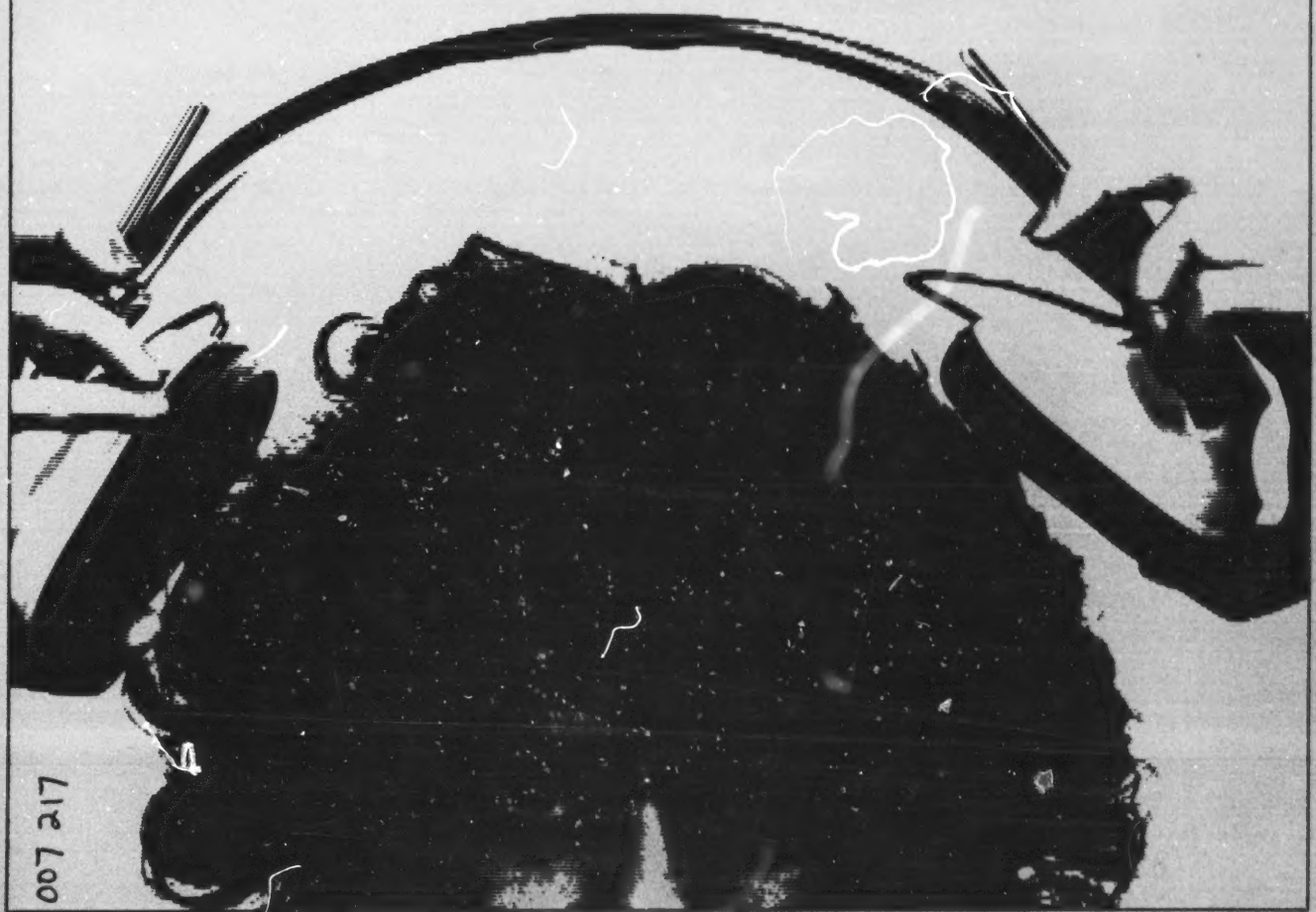

CS 007 217

FINAL REPORT: Grant NIE-G-81-0112

A. Summary

The major purpose of this project was to determine if subjects could process speech information effectively when they were required to listen to "skimmed" versions of recorded passages played back at accelerated rates. It was assumed that rapid reading rates are realized both by reading words rapidly and by skipping over (skimming) some words, so that not all words are actually read. This project simply attempted to demonstrate that effective high-rate processing through the auditory mode could similarly be achieved. The combination of skimming and frequency-controlled speech acceleration resulted in effective listening presentation rates of 500 words per minute (wpm).

Two experiments were completed. The basic task involved listening to a short passage followed by a test consisting of 6 short answer, 6 multiple choice, and 6 true-false questions. Presentation rates varied from 180 wpm (normal) up to a maximum of 500 wpm. Some subjects had prior practice with accelerated and skimmed presentations, others did not. Test performance declined as presentation rate increased. The only evidence that prior speed listening practice facilitated performance appeared with the fastest rates on the first of two testing days. Efficiency, as measured by the number correct per minute of study time, increased directly with increases in presentation rate.

B. Utilization of Research

"Speed Listening: Exploring an Analogue of Speed Reading" was clearly a demonstration project, designed to explore whether subjects can combine "skimming" and rapid processing skills for extracting information from auditory presentations. The utility of this research was in the potential for application for reading disadvantaged individuals and for situations where communication must be restricted to auditory channels. Of course, the nature of the advantage is in the reduction of time requirements for gaining information. If this can be done effectively and efficiently, then the approach may have considerable utility.

C. Project Personnel

1. Papers or Publications

Wallace, W. P., & Koury, G. Comprehension following speed listening at 500 words per minute. Paper presented at 23rd Annual Meeting of the Psychonomic Society, Minneapolis, November 11, 1982.

2. Research Collaborators

a. Wayne Carr, M.A. - Student assistant paid on an hourly basis: Mr. Carr was admitted to the Ph.D. program in Experimental Psychology in the Fall of

1981. He began working on the Speed Listening project on a limited basis during the latter part of that semester. His professional interests are in biofeedback, and he will not be pursuing research in speed listening for his doctoral dissertation.

b. Mary Ruth Glasgow, M.A. - Graduate Student Research Assistant: Ms. Glasgow, was admitted to the Ph.D. program in Experimental Psychology in the Fall of 1982. She worked on the project during the past Fall semester, and she is continuing to do so this semester on a voluntary basis. Her dissertation is in the "planning" stage. Ms. Glasgow is currently interested in systematically exploring speed listening as a function of the nature of the listening material and background interests and aptitudes of the listener.

c. Georgette Koury, B.A. - Graduate Student Research Assistant: Ms. Koury was admitted to the M.A. program in General Psychology in the Spring semester of 1982. She worked on the project during the Spring of 1982 and the Fall of 1982. Prior to this she had worked with the principal investigator as an undergraduate student assistant. She is currently working on project-related research this

semester on a voluntary basis. Her Master's thesis is in the "planning" stage, and her current interests are in contrasting and comparing speed listening presentations with appropriate video presentations.

D. Technical Report

Introduction

In speed reading, impressive rates (e.g., 500 words per minute) may actually be achieved by a combination of two different activities on the part of the reader. Most likely, the reader will have read words at a high speed, and he or she will have skipped over some words. Thus, not all words will have been read, and those that were read were likely processed at a high speed. The purpose of the proposed research is to develop and evaluate analogous procedures for processing information by listening.

Recorded speech will be accelerated by combining two techniques of compression: non-selective and selective removal of speech segments. In principle, non-selective techniques involve removing very short segments of the speech record (e.g., every other .02 sec. interval may be discarded) and abutting the remaining segments in time. The technique does not produce distortions in pitch. Selective techniques

involve removing whole words or phrases, specifically those not "essential" to the message. What remains of the message may then be read directly onto a tape without any time gaps or distortions. It is important to preserve the appropriate intonation patterns since these are known to be relevant for intelligibility (Wingfield, 1975; Wingfield, Buttet, and Sandoval, 1979). Selective editing can be done by computer following certain word-deletion rules. This selective deletion procedure may result in a processing activity similar to that experienced by speed readers who actually skim or skip over individual words. It should be noted that the rates referred to in the speed-reading analogy are on the order of 500 words per minute (wpm). Thus, the validity of unsubstantiated claims of extreme speed reading rates (e.g., promotional claims that you can "triple your reading rate while increasing your comprehension") is not a relevant issue to this project (see Carver, 1972).

The speaker-listener relationship provides two foci for improving the efficiency of processing auditory information: the output stage and the input stage. At the output level, the speaking rate can be increased to a point where it is optimal for normal listening capacities. Research on accelerated speech has usually involved playing a recording back at a speed faster than it was originally recorded, or

removing small segments of a speech sound and abutting the remaining segments in time. The first technique normally produces a noticeable frequency distortion that degrades the intelligibility of the original message (e.g., Daniloff, Shriner, & Zemlin, 1968; Kurtzrock, 1957; Wallace & Koury, 1981). The second technique does not produce frequency distortions, and it is the technique that will be used in the proposed research (nonselective deletion). The selective deletion procedure represents a second method for increasing the effective speech rate. This procedure involves simply removing "unimportant" speech sounds (with the word the unit of analysis) so the remaining message contains only "essential" words.

At the input level, it should be possible through practice and training procedures to improve efficiency of processing auditory information. It has been shown that subjects who have had experience in listening to accelerated speech comprehend more than nonexperienced subjects (e.g., Friedman & Orr, 1967: Orr, Friedman, & Williams, 1965). Thus, recorded messages will be presented at very rapid rates by combining the nonselective and selective compression techniques, and listeners will be given practice with this type of presentation. The anticipated outcome is that trained individuals will obtain "impressive" scores on

comprehension tests over information contained in such presentations. That is, they should achieve higher scores than untrained individuals tested over the same accelerated passages, and they should achieve scores that approximate the scores of individuals who listen to the same passages presented at normal rates. However, the savings in terms of time may be considerable as the same information may be conveyed in one-third the time with the accelerated presentations compared with the normal-rate presentations.

At this point a comment about the concept of comprehension is in order. At a general level comprehension is most closely synonymous with understanding. However, the comprehension process is quite complicated. First, testing situations involve more than one type of comprehension. For example, is the language understood by which information is conveyed? Are the facts, theories, etc., presented in the message understood? Are the implications, inferences, etc., from statements in the message understood? One or more of these aspects of comprehension may be involved in any testing situation. Invariably other processes in addition to comprehension are operating in the testing situation. Successful test performance may be influenced by comprehension processes (whatever these are), memory processes, attentional processes, motivational processes, test experience, etc. Although labeled as comprehension, the

interest in this project centers on a set of processes that operate enabling a reader or listener to answer substantive questions about a previously presented message.

In view of difficulties with the concept of comprehension and its measurement, the use of different testing procedures is particularly important (Carroll, 1972; Orr, 1971). Although the multiple-choice method of testing has been the most popular, this project will also include other testing procedures (e.g., true-false, short-answer).

Several experiments have indicated that both intelligibility (identification of what was said) and comprehension of accelerated speech improve with practice (Miller & Licklider, 1950; Orr & Friedman, 1967; 1968; Orr, et al., 1965; Shields, 1975; Voor & Miller, 1965; Wallace & Koury, 1981), although there is some question about whether appropriate control groups have always been used (Foulke & Sticht, 1969). There have also been occasions where there has been little evidence for improvement with practice (e.g., Fairbanks, Guttman, & Miron, 1957; Lass, Foulke, Nester, & Comerci, 1975). However, at this point it is important to draw a distinction between the concepts of practice and training. Most studies have dealt with practice that consisted of just listening to accelerated speech. Friedman and Orr (1967) did present summaries of key words prior to

listening practice, and Resta (1971) gave unspeeded feedback, previews of specific words and gradually increasing rates. But, in general, investigation of training programs other than just practice listening represents a relatively unexplored area. Experiments investigating practice in listening to compressed speech usually involve relatively brief practice periods, although Orr and Friedman (1968) gave their subjects approximately 35 hours of massed practice over a five-day period.

The proposed project grew out of an interest in a phenomenon of speed listening and long-range considerations of its applied potential. Considerable savings in time could be achieved in those situations in which speech communication must be relied on (e.g., in "reading" for the blind). Future development of speed listening programs and facilities could reduce disadvantages that blind students face in obtaining text information. It is not uncommon for sighted students to be reading at 200-500 wpm, whereas normal braille reading rates are about 110 wpm and normal speaking rates may vary around 140 to 190 wpm.

At the theoretical level the concern is with the viability of a speed-listening phenomenon. That is, is speed-listening contraindicated by logical considerations or prevailing theoretical conceptualizations? The state of the

art in theorizing about speech perception is not nearly so complete to render a phenomenon of speed listening (at the levels envisioned in this project) as inadmissable. This certainly does not mean that there can be no skeptics, but rather that the question can be addressed empirically.

Research on accelerated speech has not promoted too much theoretical activity. A report by Meadows (1975) entitled: "Towards a Theory of Rate-Controlled Speech" provided few theoretical insights. Rather than being a theoretical paper as the title implies, it was simply a call for standardizing procedures and reporting practices in this field as a necessary prelude to the emergence of theory. Sticht (1972; 1975) presented a position that auding develops prior to reading, and the acquisition of reading skills develops from intelligence and auding skills. Further, the maxima for auding and reading rates will be the same given the full development of reading-decoding skills. Since reading uses the same language base and the same conceptual base as auding, Sticht argued that maximum reading and listening rates must be the same. This is a counterintuitive position; normally, reported reading rates are far in excess of reported listening rates. Sticht made a reasonable case for closely examining whether the commonly accepted difference in

reading and listening rates is more apparent than real. He argued that when each word is actually read for reading (that is, individual words are not skipped) and each word is spoken for auding, then maximal rates for both are between 250 and 300 wpm. It is of interest to note that equivalent levels of reading and listening comprehension have been reported for presentation speeds of 180, 250, and 380 wpm (Hausfeld, 1981). Sticht did not address the issue of skimming in auding, but it is consistent with his approach that if information can be obtained effectively from skimming in reading, it should also be possible to obtain information effectively from parallel operations in auding.

The relationship between speech and reading is complex. Speech has been regarded as a relatively simple acquisition in contrast to the considerable difficulty involved in learning to read (Cooper, 1972; Jenkins & Liberman, 1972; Mattingly, 1972; Shankweiler & Liberman, 1972). Certainly, there is less formal instruction in understanding spoken language compared to written language, the former skill comes earlier in development than the latter, spoken communication is highly developed in most cultures whereas written communication is very primitive or nonexistent in some cultures, and the blind have little difficulty in mastering a spoken language whereas the deaf have considerable difficulty with

written language. "The apparent naturalness of listening does not mean that it is in all respects a more efficient process. . . Listening is always a slower process: even when speech is artificially speeded up in a way which preserves frequency relationships, 400 words per minute is about the maximum possible rate" (Mattingly, 1972, p. 125). There seems to be a paradox here in that spoken language is viewed as primary, natural, and easier to come by than written language. Yet, in terms of time and efficiency in communicating information, reading is considered superior.

At this time identification of a maximum listening rate is premature. Based on their review of the literature, Foulke and Sticht (1969) concluded: "it is clear that an adequate training experience for improving the comprehension of accelerated speech has yet to be found" (p. 60). Of course, there must be limits on human processing capacities, and it is true that some experts have indicated that 400 wpm may be near that capacity (e.g., Foulke & Sticht, 1967; Gerber & Scott, 1971; Overmann, 1971). <u>However, the simple tactic of combining nonselective sampling procedures with selective sampling procedures has not been explored</u>. This combination will force listeners to process at a rapid rate and to "skim" in listening. The results in terms of the

original passages may be listening rates approximately twice as fast as what has been considered maximal. Practice will most likely be necessary if individuals are to process information contained in such abbreviated and accelerated messages effectively.

The prevailing viewpoint is that the rate of processing information by listening cannot match the rate of effective processing by reading. It has been claimed that: "There is a certain sense to the exploration of that tool [time-compressed speech], but I think we know that it cannot succeed because there is only an incomplete analogy between the processing of information in the visual reading and auditory senses . . . Hence a vast amount of information can be stored in print and can be scanned by the eye in a variety of ways and at a variety of rates. The ear has a high capacity to perform temporal resolutions, but it has acquired this ability at the expense of not being able to perform anything like the eye's scanning" (Deese, 1971, p. 250). The reader can control the reading to a certain extent and can skip over words and phrases, whereas the listener cannot control the content or pace of input (see Just & Carpenter, 1980). In contrast, Sticht (1975) has argued impressively that reading and auding rates <u>per se</u> are subject to the same limits and are likely quite comparable when each word is read

or spoken. No major effort at training speed listening has been tried, so it is not known whether anything analogous to scanning can be carried out by the ear. The selective sampling procedure introduced in this project represents an experimenter-controlled scanning forced upon listeners, and when combined with nonselective sampling procedures, effective listening rates may be produced that provide closer approximations to the more rapid processing assumed to occur with visual reading.

In summary, the basic idea underlying the present approach to developing speed listening skills is based on this parallel between reading processes and listening processes. When every single word is processed in sequence, then the optimal reading and listening rates should be similar. However, it is known that reported reading rates commonly exceed the maximal levels that have been achieved in listening. It is reasonable to assume that very rapid reading rates are realized because every individual word has not been processed, that is, readers skip over words and skim while reading. Arguments have been made from physiological data that it is not possible to read words as fast as some of the extreme claims would have us believe. The purpose of

this project was to explore the range of optimal listening rates by combining pitch-corrected, accelerated playback procedures with skimming in listening to recorded material.

Experiment 1

Experiment 1 was the major demonstration experiment. It involved three groups of subjects; a control group that had no practice experience prior to the critical test days, a group that had three one-hour practice sessions listening to normal-rate speech only prior to the critical test days, and a group that had three one-hour speed-listening practice sessions prior to the critical test days. There were two critical test days, with subjects taking five different tests each day. The tests consisted of 18 questions (6 short answer, 6 multiple choice, and 6 true-false).[1] There were five different listening conditions: On each test day one original passage was presented at a normal speed (N) (approximately 180 wpm), one "skimmed" passage was presented at a normal speed (S) (resulting in an effective rate of approximately 230 wpm), one original passage was presented at

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1. An essay test was also included, but an error was made in administering this test in the first replication. The error did not affect the other tests.

the accelerated rate (AN) (approximately 400 wpm), and one skimmed passage was presented at the accelerated speed (AS) (an effective rate of approximately 500 wpm). The fifth test was given without benefit on any presentation of the appropriate passage (O). This condition provides a baseline control for estimating the levels of performance that result from guessing, "testwise" subjects, and information subjects knew before the experiment. Thus, there were 15 conditions in the experiment resulting from the combination of the three practice conditions and the five listening-rate conditions. The former variable was a between-groups manipulation and the latter variable was a within-groups manipulation.

Method

Materials. The materials used for this study consisted of excerpts from short stories and factual essays. They were selected from a wide range of sources. The accompanying comprehension questions were taken from those that were published with the essays, if any were available, but more frequently, they were prepared by the project personnel. A total of 32 listening presentations were recorded in both an original, intact version and in a "skimmed" (word-deleted) version. The nature of the skimming will be discussed in more detail in the next section. For each passage the

necessary questions were selected or prepared. Individuals preparing test questions only had access to the original, intact versions of the essays.

Ten of the 32 passages were selected for use as the critical test passages. The remaining passages provided material for use during practice days. The ten passages used for the two test days ranged in length from approximately 900 words to approximately 1,675 words, with a mean length of approximately 1,200 words. The range of topics represented by the test passages may be seen from the listing of titles in Table 1.

The tests for each of the ten passages identified in Table 1 were administered equally often across subjects on the first and second days, and under each of the five listening conditions. Also, for each test day the temporal order of the five listening conditions was balanced, i.e., condition N was represented equally often as the first, second, third, fourth, and fifth test of the day, etc.

Procedures for Producing Speed Listening. The rapid listening rates in this experiment were achieved in two ways. First, individual words were simply skipped in reading the passages for recording. Thus, two versions of each passage were recorded: an intact version for which all of the words in the passage were recorded, and a skimmed version that

Table 1

Ten Test Passages Identified By Title

"Eagles Over Wyoming"

"A Different America"

"Exploring Antarctica"

"The Wonder of Water"

"The Mythology of Bachelorhood"

"Fit or Fat"

"My Father Played for Me"

"The Widower"

"Infinite Horizons: Space After Apollo"

"How to Speak in Public"

resulted in many individual words being omitted when the passage was recorded. Second, the recorded tapes were sped up during the playback period with frequency corrected. This speech compression was accomplished with the Varispeech II speech compressor. Both of these procedures reduce the amount of time it takes to play back the passages, compared to the normal speed playback of the original, intact recording.

Rules for deleting words from passages were developed and applied systematically to each passage. An effort was made in developing these rules to focus on classes of words that intuitively seemed less important to conveying meaning. Table 2 summarizes the major rules, examples, and exceptions used in deriving the skimmed versions of the passages. Application of these rules to the test passages resulted in a 21% to 31% reduction in the number of words, with an average reduction in number of words contained in a passage of 25%.

The test passages for the normal and skimmed versions played back at normal recording speed averaged 180 wpm and 230 wpm, respectively. It should be noted that for the skimmed passages a 230 wpm presentation rate is determined by dividing the number of words in the original version of the passage by the number of minutes it takes to play back the skimmed version. This procedure is common in measuring

Table 2

Summary of Word Deletion Rules, Examples, and Exceptions

Deletion Rule	Examples	Exceptions
Articles	a, an, the	
Adverbs	very, too, similarly, etc., and most words ending in ly	if followed by a period or question mark; or if preceded by negation
Conjunctions	and, but, or, until, etc.	if word preceding and word following conjunction are identical
Possessive Pronouns	my, his, their, etc.	
Auxiliary Verbs	is, are, was, etc., when following word ends in ed or ing	
Vague Quantifiers	some, almost, every, sometimes, etc.	if preceded by negation
Exclamations	ah, oh, etc.	
Idiomatic Expressions	on the other hand, so to speak, from time to time, for example, among other things, as a matter of fact, it goes without saying, etc.	
		Any italicized word or any word beginning with a capital letter excluding the first word in a sentence.

reading speed, as no effort is made to relate the actual number of words read to time. The playback speed of the AN and AS passages was determined on a passage-by-passage basis. A slightly different setting on the Varispeech was determined for each original passage and each skimmed passage. The setting was determined such that each AN passage was played back at 400 wpm and each AS passage was played back at an effective rate of 500 wpm.

Procedures. The experiment took place over a five-day period. Each subject had to be willing to serve in the experiment for one hour per day, Monday through Friday. Each subject would first appear at the laboratory on a Monday. Based on a predetermined random order, the subject would be assigned to one of three groups: a no-practice control group (C), a normal-practice group (NP), or a speed-practice group (SP). All subjects took a one-minute speed reading test on the Monday of the week they served in the experiment, then if the subject was assigned to Group C, he or she would be dismissed and required to return for Thursday and Friday of that week. Subjects assigned to Groups NP and SP moved directly from the short speed-reading test to their appropriate practice group. Subjects in Group NP spent approximately one hour at each of the Monday, Tuesday, and Wednesday sessions listening to normal-rate recorded passages

(the listening materials were neither skimmed nor accelerated). Tests were given after some practice passages. Subjects in Group SP spent a comparable amount of time listening to passages and being tested. However, their listening experiences focussed on skimmed and accelerated presentations. All groups received the same testing condition on the fourth and fifth days of the experiment. The practice and test activities took place in the same small carpeted research room, which was located off the main traffic flow in the Psychology building. The recordings were played to subjects through stereo headphones to reduce extraneous noise and distortion.

Subjects. A total of 60 introductory psychology students served in this experiment.[2] Twenty subjects were randomly assigned to each group. This number of subjects allowed for equal representation of each specific passage under each of the five presentation conditions.

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2. A parallel experiment in reading involving 60 subjects is in progress. This experiment could not be completed during the past Fall semester due to mechanical delays in preparing appropriate video displays of the passages.

Results

Number Correct. Three different types of comprehension questions were asked for each test passage. Each type of question appeared to discriminate among conditions, although they did not appear to be equally sensitive. Table 3 presents the mean number correct per test separately for each type of question. It will be recalled that Condition 0 is a baseline control condition in which subjects were asked to answer the questions without the benefit of listening to the appropriate passage. Subjects in this condition averaged nearly six correct answers out of a possible score of 18 correct. Correct responding was highest following the normal, intact presentations, and declined systematically as presentation rate increased. This relation held for each type of question, although the range was restricted with the true-false questions. It should be noted that performance following the 500 wpm (Condition AS) presentations was well above the chance level in Condition 0.

Table 4 presents the mean total number correct (combined across the three types of test items) for each practice group as a function of presentation condition. The results appear to be reasonably consistent for each practice group in showing that all listening conditions surpassed the no-presentation condition (Condition 0) and in showing that performance declines as presentation rate increases. These

Table 3

Mean Number Correct as a Function of Type of Question

	Test items			
Listening Condition	Multiple Choice	True-False	Short Answer	Total
O	2.07	3.10	.78	5.95
N	4.42	4.52	3.26	12.20
S	3.92	4.21	2.91	11.04
AN	3.78	4.14	2.46	10.38
AS	3.30	3.79	2.00	9.09

data were subjected to an analysis of variance which contrasted the simple effects of practice treatments (groups C, NP, and SP) at each test day-listening condition combination. Overall, the presentation conditions (O, N, S, AN, and AS) had a substantial effect on the number of correct responses, F (4, 228) = 134.37, $p < .01$, $MS_e = 5.31$. There was also better performance on the second test day than on the first test day, F (1, 57) = 22.41, $p < .01$, $MS_e = 6.04$. The interaction between presentation conditions and test days was also significant, F (4, 228) = 4.18, $p < .01$, $MS_e = 7.27$. Condition O was the only condition in which performance on Day 2 did not exceed performance on Day 1. The three practice groups did not differ at any of the 10 combinations of test days and listening presentations conditions.

In view of the relatively high level of chance performance on true-false questions, the preceding analysis was repeated with performance measures restricted to scores on the multiple choice and short answer questions. Table 5 presents the mean number correct for these two types of test items. Statistically, the same effects that were significant when true-false questions were included, were again found to be significant. For the listening presentation condition variable, F (4, 228) = 127.25, $p < .01$, $MS_e = 3.36$; for test days, F (1, 57) = 42.05, $p < .01$. $MS_e = 3.31$; and for the interaction of these two variables, F (4, 228) = 5.63, $p <$

Table 4

Mean Number Correct on Multiple Choice, Short Answer, and True-False Questions

		Listening Conditions				
Group	Day	O	N	S	AN	AS
C	1	6.55	11.75	10.40	9.00	8.30
	2	6.05	12.25	11.10	10.50	9.40
NP	1	5.60	11.45	10.30	9.35	7.85
	2	5.80	13.25	11.65	11.80	10.55
SP	1	6.70	13.15	11.55	10.05	9.50
	2	5.50	12.60	12.40	12.60	10.30

Table 5

Mean Number Correct on Multiple Choice and Short Answer Questions

		Listening Conditions				
Group	Day	O	N	S	AN	AS
C	1	3.15	7.40	6.15	5.10	4.00
	2	2.80	7.60	6.75	6.45	5.65
NP	1	2.75	7.05	5.70	5.35	3.85
	2	2.85	8.55	7.75	7.40	6.60
SP	1	3.40	8.20	7.00	5.90	5.90
	2	2.40	8.10	8.30	7.80	6.35

.01, MS_e = 4.38. In addition, there was one comparison in which there was a significant difference as a function of practice groups. For the AS condition (500 wpm) and on the first test day, the three practice groups differed significantly, F (2, 57) = 4.31, $p < .05$, MS_e = 6.06. Subsequent pairwise comparisons revealed that Group SP was superior to Group C, F (1, 57) = 5.96, $p < .05$, and Group SP was superior to Group NP, F (1, 57) = 6.93, $p < .05$. Groups C and NP did not differ. Whatever advantages in comprehending passages presented at 500 wpm that resulted from three practice days of speed listening were quickly compensated for during the first test day, as the three practice groups did not differ on the second test day.

In this experiment each subject was tested under each presentation condition. Optimal performance was obtained with the normal, intact presentations. Tables 6 and 7 indicate the performance levels for each condition relative to how well subjects performed under the optimal condition (Condition N). For example, if a subject had 10 correct in Condition N and 4 correct in Condition O, the performance with Condition O would be 40% of the optimal level demonstrated. Table 6 shows the relative performance levels based on all test items, and Table 7 shows similar scores restricted to the multiple-choice and short-answer test

Table 6

Proportion Correct Relative to the Normal Condition Based upon Multiple Choice, Short Answer, and True-False Questions

		Listening Conditions			
Group	Day	O	S	AN	AS
C	1	.557	.885	.766	.706
	2	.494	.906	.857	.767
NP	1	.489	.900	.816	.686
	2	.438	.886	.890	.796
SP	1	.510	.878	.764	.783
	2	.436	.984	1.000	.817

Table 7

Proportion Correct Relative to the Normal Condition

Based Upon Multiple Choice and Short Answer Questions

		Listening Conditions			
Group	Day	O	S	AN	AS
C	1	.426	.831	.689	.540
	2	.368	.888	.849	.743
NP	1	.390	.808	.759	.546
	2	.333	.906	.865	.772
SP	1	.415	.854	.720	.720
	2	.296	1.025	.963	.784

items only. Group SP appears to be consistent in showing the smallest relative loss in performance at the 500 wpm rate (AS), but the differences are small in magnitude.

Efficiency. A meaningful way of evaluating speed listening procedures is in terms of efficiency. That is, various presentation rates may be compared in terms of the number correct obtained per unit of study time. The no-presentation control condition is excluded from these comparisons because it represents a zero study time condition and one for which no information was derived from listening. The efficiency scores are presented in Tables 8 and 9, with the data in Table 8 based on all test items and the data in Table 9 restricted to only the multiple choice and short answer questions. It seems fairly clear from these tables that comprehension performance in terms of efficiency was highest at the 400 wpm and 500 wpm presentation rates.

Discussion

With regard to the purpose of this project, the initial experiment offers some promise. It was of interest to determine if skimmed versions of listening texts would be comprehensible when presented at very fast rates. Subjects who listened to these 500 wpm passages clearly showed evidence of comprehension. They answered questions about the material they listened to with much greater success then

individuals who had not listened to the passages. It was also obvious that comprehension performance following "speed listening" was well below levels achieved following more conventional listening presentations. However, in terms of efficiency, the amount of information acquired per unit of listening time was greater in the speed-listening conditions.

One major surprise from this experiment was that prior practice in speed listening had so little effect. Group SP showed only modest gains as a result of having had three hours of practice with speed listening. The only difference among the practice groups that reached acceptable significance levels involved the performance on the 12 multiple choice and short answer questions. On the first day of testing the 500 wpm passages (AS), the SP group performed better than the C and NP groups. More powerful effects of the practice experience had been anticipated, but since we were uncertain about how much practice would be needed and about what sorts of practice experiences would be critical, a second experiment was run concurrently with the first experiment. The second experiment was a limited version of the first experiment in that only the N and AS test conditions were included. However, subjects were given approximately 16 hours of practice listening experience before the final tests were administered.

Table 8

Efficiency Scores: Average Number Correct Per Minute of Study Time for Multiple Choice, Short Answer, and True-False Questions

		Listening Conditions			
Group	Day	N	S	AN	AS
C	1	1.83	2.07	3.11	3.58
	2	1.90	2.21	3.63	4.05
NP	1	1.78	2.05	3.24	3.38
	2	2.06	2.32	4.08	4.55
SP	1	2.04	2.30	3.48	4.09
	2	1.96	2.46	4.36	4.44

Table 9

Efficiency Scores: Average Number Correct Per Minute of Study Time For Multiple Choice and Short Answer Questions

		Listening Conditions			
Group	Day	N	S	AN	AS
C	1	1.15	1.22	1.76	1.72
	2	1.18	1.34	2.23	2.44
NP	1	1.10	1.13	1.85	1.66
	2	1.33	1.54	2.56	2.84
SP	1	1.28	1.39	2.04	2.54
	2	1.26	1.65	2.70	2.74

Experiment 2

The purpose of Experiment 2 was to expand the practice experience in speed listening, both in time and scope. Over a period of approximately six weeks student volunteers appeared at the laboratory for three one-hour sessions per week. Subjects were given practice in listening and taking tests with intact and skimmed passages presented at normal rates, and with intact and skimmed passages presented at a variety of accelerated rates. Specific practice passages were repeated so that subjects had experience with speed listening to familiar passages. Three critical test days were included in the six week session, with each test day involving the presentation and testing of four different passages, each presented for the first time. On each critical test day two test passages were presented in the original intact versions (about 180 wpm) and two test passages were presented in the skimmed and accelerated versions (500 wpm). The first test day occurred at the first session without any practice listening. The second test session occurred about midway through practice, after approximately eight hours of speed-listening practice. The third test session took place at the final meeting following approximately 16 hours of speed-listening practice.

Method

Materials. The same recorded passages and short answer, multiple choice, and true-false questions used for Experiment 1 were used in this Experiment. In addition, a six-point essay question was the first test question asked following each critical test passage. The question asked subjects to identify, in either narrative or outline form, the six major points in the preceding passage.

There were 12 critical test passages, with four presented on each of the three critical test days. Nine of the test passages from Experiment 1 (see Table 1) were used in this experiment, plus excerpts from passages entitled: "The Arsenal," "The More Abundant Life," and "On the Wagon." The excerpt from "Fit or Fat" was the only test passage from Experiment 1 that was not included as a test passage in Experiment 2. The remaining 20 passages that had been prepared for Experiment 1 were used as practice materials.

Procedures. The experiment was scheduled to include 18 one-hour sessions over a six-week period. The first, ninth, and eighteenth sessions were critical test sessions. All other sessions were practice sessions that included primarily practice listening, with additional time for discussions and tests. Also, the practice listening experiences included a variety of presentation rates ranging from normal to 500 wpm,

and frequently involved listening to the same story several times (e.g., at different presentation speeds). Of course, test passages were only used a single time on the designated critical test day.

During test sessions each subject listened to four successive passages. After each passage a test was given consisting of an essay question, six short answer questions, six multiple choice questions, and six true-false questions. At each session two of the test passages were presented intact and at the normal speaking rate (N). The remaining two test passages were presented in the skimmed version and at an accelerated rate that produced an effective listening rate of 500 wpm (AS). For half the subjects the test passages were presented in an N, AS, AS, N order, and for the other half they were presented in an AS, N, N, AS order. Each specific test passage was presented equally often under N and AS conditions.

Subjects. Eighteen subjects participated in this experiment. Each subject served in all conditions (the N and AS test conditions and without practice and following 8 and 16 hours of practice). The experiment fits a quasi-experimental design involving a single pretest-posttest format. It should be noted that the no-practice "control" condition is represented by the pretest performance and the

experimental practice conditions are represented by the second and third posttest stages. This design leaves the interpretation of pretest-posttest change open to time-related alternative interpretations (in addition to the practice experience), since the control condition was observed nearly three or six weeks prior to when the experimental conditions were observed. This design difficulty was tolerated at this juncture because of the exploratory emphasis of the research. The eighteen subjects were enrolled in introductory psychology classes at the University of Nevada. Each subject received credit towards a laboratory requirement for the course plus a ten dollar cash award upon completion of the experiment.

Results

Number Correct. In this experiment the first critical test was given prior to the subjects receiving any practice sessions. Thus, the first test day was comparable to the no-practice control group (C) of Experiment 1. The second and third tests were administered after subjects had speed-listening practice, thus these test sessions were comparable to the SP groups of Experiment 1 (only with a longer, more extensive practice experience). The types of test questions were the same between experiments with the addition of a six-point essay question in this experiment. The essay

questions were scored without knowledge of the presentation condition (N or AS) that preceded the test. Table 10 presents the mean number correct for each type of question. Again, it may be seen that each type of question discriminated between N and AS listening conditions, with true-false questions again appearing to be the least sensitive. Statistical tests will be reported on the combined multiple choice, short answer, and true-false questions and on only the multiple choice and short answer questions to parallel the analyses from Experiment 1. However, it should be noted that inclusion of the scores on the essay tests did not alter any statistical outcome or conclusion from what is reported.

The statistical analyses on the number of correct responses revealed only one significant effect. Performance on the comprehension tests following normal-rate listening was superior to that following speed listening: $\underline{F}$ (1, 17) 55.40, $p < .01$, $MS_e = 21.90$ for the multiple choice, short answer, and true-false tests; and $\underline{F}$ (1, 17) = 69.98, $p < .01$, $MS_e = 12.88$ for the multiple choice and short answer questions only. In neither case was test performance influenced by the practice experience, and more importantly, the speed-listening practice did not uniquely benefit performance on the speed-listening tests. In this experiment performance differences between the N and AS conditions were

Table 10

Mean Number Correct as a Function of Type of Question

	Test Items							
	Multiple Choice		True-False		Short Answer		Essay	
	N	AS	N	AS	N	AS	N	AS
Test 1 (C)	4.36	2.94	4.28	4.00	3.39	1.64	4.50	3.22
Test 2 (SP_1)	4.67	3.22	4.67	3.86	3.47	1.94	4.53	3.89
Test 3 (SP_2)	4.36	3.14	4.44	4.14	3.17	1.86	4.42	3.53

generally smaller after the practice experience than before the practice experience, however the magnitude of these relative differences was quite small. The proportion correct in the AS condition relative to the level of performance achieved in the N condition for the multiple choice, short answer, and true-false questions was .714 for the first test, .705 for the second test, and .763 for the third test. For the multiple choice and short answer tests only, the corresponding proportions were: .591, .635, and .664, respectively. For all test scores including the essays, the proportion correct on the first AS test (relative to the first N test) was .714, with values of .745 for the second critical tests, and .773 for the third critical tests.

Efficiency. As was true in Experiment 1, the performance in the AS condition produced higher efficiency scores than performance in the N conditions. The averages for number correct per minute of study time are presented in Table 11. Efficiency scores are presented separately in this Table for the different combinations of test items that have been reported.

Discussion

Experiment 2 was consistent with Experiment 1 in demonstrating impressive levels of performance on comprehensive tests following skimmed-accelerated listening presentations at rates of 500 wpm. Subjects scored higher on efficiency measures with the AS presentations than with the N

Table 11

Efficiency Scores: Average Number Correct Per Minute of Study Time

	Multiple Choice, Short Answer, and True-False Items		Multiple Choice and Short Answer Items		Multiple Choice, Short Answer, True False, and Essay Items	
	N	AS	N	AS	N	AS
Test 1 (C)	1.92	3.81	1.24	2.04	2.64	5.25
Test 2 (SP_1)	2.04	4.01	1.30	2.30	2.77	5.74
Test 3 (SP_2)	1.91	4.06	1.20	2.22	2.62	5.63

presentations. Overall, the rapid presentation rates produced about a 30% reduction in comprehension (as measured by the present set of tests) compared to the performance levels achieved with the normal listening rates.

One major surprise in the data from Experiment 2 was the absence of practice effects. The relatively impressive levels of performance following the 500 wpm presentations were achieved without any prior experience with this type of presentation (e.g., 71% of normal for all test items on the first test day compared to a level of 77% of normal on the third test day after about 16 hours of practice). In both Experiments 1 and 2 there were only very small benefits demonstrated as a result of the practice listening experiences.

Future Developments

Rather than presenting a general summary and discussion of results, this final section will be directed towards a brief discussion of future developments from the Nevada Laboratory. A major concern we have is with a reexamination and reevalution of the practice experience provided in these experiments. The personal experiences the research team had with speed listening, our intuitions, and our contact with the literature led us to expect greater benefits from speed-listening practice than what materialized. For example, if on the 500 wpm passages control subjects could achieve 60% to

70% of the performance level achieved on normal-rate passages, then a well-practiced subject was expected to be performing at 80% to 90% of the normal-rate level. While there was a consistent pattern favoring the speed listening practice groups, the differences were small and statistically significant on only the first test day in Experiment 1. Perhaps our expectations were unrealistic or perhaps the practice experience needs to be refined and developed more rigorously.

We currently have a study in progress that represents a speed reading parallel to Experiment 1. We believe this is an important study to report with Experiment 1 for indirect comparison purposes. With these materials and procedures, we have an estimate of the comprehension decrement that results from very rapid listening rates. The reading experiment represents an effort to obtain similar estimates following visual study with conditions and procedures that approximate those used for Experiment 1. Based on our working assumption that common cognitive processes are involved in reading and auding, our expectation is that performance decrements due to forced increases in reading rates will be comparable to what was shown for listening. It is anticipated that this reading experiment will be completed by the end of the current Spring semester.

The results from both Experiments 1 and 2 showed rather impressive levels of performance following listening presentations of skimmed-accelerated passages at 500 wpm. For example, in Experiment 1 on the multiple choice and short answer questions following the 500 wpm presentations, subjects averaged 68.4% of the number correct achieved following the normal-rate presentations. Without any study (Condition 0) the level of performance was 37.1% of normal. In view of the fact that subjects must have been processing a substantial amount of the information presented at 500 wpm, it may be worthwhile to push the rates upward to estimate where performance will break down to the point that the very rapid rates in speed listening would be no better than no input. Both the degree of forced skimming and the playback rates can be increased to extend the effective presentation rates (that is, with the present procedures effective rates between 600 and 700 wpm may be produced without too much difficulty).

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